Small Business Innovation Research/Small Business Tech Transfer

Composite Matrix Systems for Cryogenic Applications, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

As an alternative material to aluminum-lithium, cryotanks developed from fiber reinforced composites can offer significant weight savings in applications for fuel containment of liquid oxygen and hydrogen. For composite materials to be accepted and utilized in these structures, they must be resistant to microcracking. It is the objective of this work to develop a matrix system for aerospace composites that alleviates all forms of microcracking from cryogenic cycling regardless of the lay-up and configuration. This will be accomplished by using a novel chemistry that provides the necessary inherent network and backbone structure for this environment combined with newly developed nano-modifiers. This technology and approach will result in a high performance matrix system that has low or no cure shrinkage combined with very low CTE and extremely high toughness. Such a matrix will be combined with carbon fibers to fabricate lightweight, high performance composites that are expected to have the microcrack and permeability resistance required for cryotank structures. It is expected that the Technology Readiness Level will be 3-4 at the end of this Phase I research.

Anticipated Benefits

Potential NASA Commercial Applications: In addition to cryotank composite structures, many composite applications and designs will benefit from the high toughness, low cure shrinkage, and low CTE of the matrix technology developed in this research. Commercial composite applications that have been limited by current matrix technology can be found in space, aerospace, and airplane structures. Specific applications that may benefit from the low CTE include high precision antennas, reflector components, and precision optical devices. The high toughness of these matrices will enable more damage tolerant composite for commercial aircraft structures, engine components such as fan blades and core cowls, and ballisitic applications. Also, this technology will enable stitched and advanced multiaxial perform to be utilized in many new applications that have been limited before by microcracking. Film adhesives for advanced structural bonding and composite cocure applications will also benefit from this technology.

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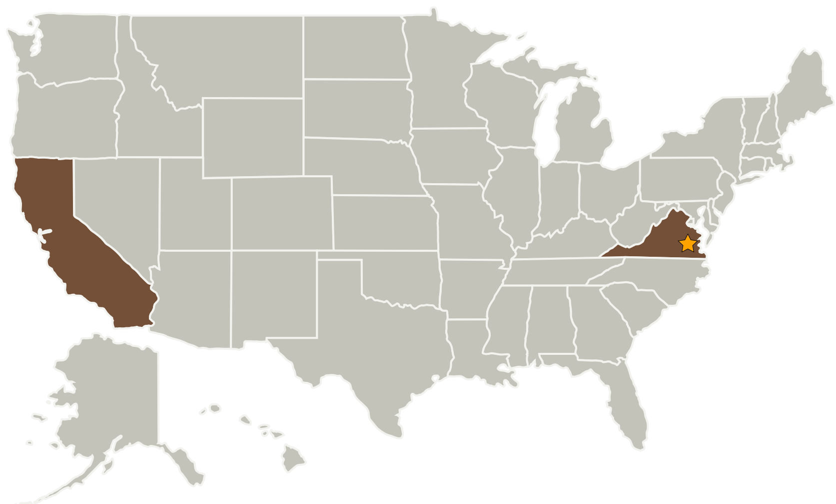
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Applied Poleramic, Inc.	Supporting Organization	Industry	Benicia, California

Primary U.S. Work Locations	
California	Virginia

Project Transitions

January 2009: Project Start

July 2009: Closed out

Closeout Summary: Composite Matrix Systems for Cryogenic Applications, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

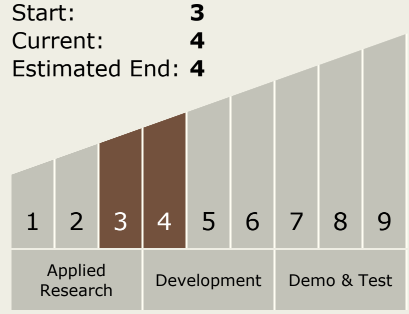
Carlos Torrez

Principal Investigator:

Rich Moulton

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  └ TX12.1 Materials
    └ TX12.1.1 Lightweight Structural Materials